

Industrial Cyber Security and Enhanced ERPS v2 Managed (PoE+) Switch for Critical Applications

DS412/DP412

Industrial 8G + 4GF Layer 2 Cyber Security Switch

The 12 Port Gigabit L2 Managed Switch DS412/DP412 supports critical cyber security features such as Port Based Security-IEEE802.1x MAB (MAC Authentication Bypass), Access Control List (ACL, MAC/IP/ARP filter), DHCP Snooping, IP Source Guard, Dynamic ARP Inspection as well as advanced redundancy features such as WoMaster ERPSv2 Plus and eRSTP. The rugged EMC design of DS412 is certified by IEC 61850-3/IEEE 1613/EN 50121-4 standard that is the best choice for substation and railway wayside applications. The PoE design for DP412 delivers up to 240W power budget over the 8 Giga PoE+ port.



**IEC61850-3
IEEE1613
DS412**

**802.3af
PoE+
DP412**



EN50121-4 NetMaster



Features & Benefit

Full Gigabit Switching and Ultra-high Throughput

- **12-port Full Gigabit** Ethernet with 8 GbE RJ45 and 4 100M/1G SFP fiber ports
- DDM function for high quality fiber connectivity monitoring
- **16K** MAC address table
- **1.5MByte** packet buffer memory for H.264 burst
- **9K** bytes jumbo frame
- Stores and forwards with non-blocking switch fabric
- **8** flexible Class of Service(CoS) queues, **512** L2 Multicast Groups for video applications

WoMaster ERPSv2 PLUS Ring Technology

- Apply Broadcom® CFM Technology for overcoming GbE copper physical limitation and providing minimum 20ms recovery time, seamless restoration time
- Inter-Operability with 3rd party ITU-T G.8032 v1/v2 ERPS switch and still remain fast recovery time
- Replace legacy Ring + Chain + Dual Homing

Enhanced RSTP(eRSTP)

- Enhance the RSTP fault recovery time performance
- Enhance RSTP performance for large ring network topologies with up to 80 switches

Extreme PoE Capability – DP412

- 8-port IEEE 802.3af/at compliant PoE, up to 30W/port
- Up to **240W** power budget
- Complete PoE management including per-port **Power Budget Control**, **PoE Scheduling** and **PoE Status**

Compliant with IEC62443-4-2 Level 3 / 4 Cyber Security

- L2-L7 IPv4/IPv6* Access Control List (ACL)
- DHCP Snooping, IP Source Guard, Dynamic ARP Inspection
- 802.1Q VLAN, Private VLAN, Advanced Port Security
- Multi-Level user passwords
- HTTPS/SSH/SFTP, 256-bit encryption
- 802.1X MAB for non-802.1X compliant end devices
- RADIUS/TACACS+ centralized password authentication

Industrial IoT LAN & Cloud Management

- Various configuration paths, including CGI WebGUI, CLI, SNMP and RMON
- Support WoMaster Software Utilities:
 - NetMaster Network Management System
 - ViewMaster for Configuration Management
 - ThingMaster*, ThingMaster OTA* for device management over Cloud*
- Support MQTT* protocol, ready to use AWS/Azure and Private Cloud Agent for cloud management
- LLDP for topology control, auto-topology drawing
- USB for easy field configuration and firmware update

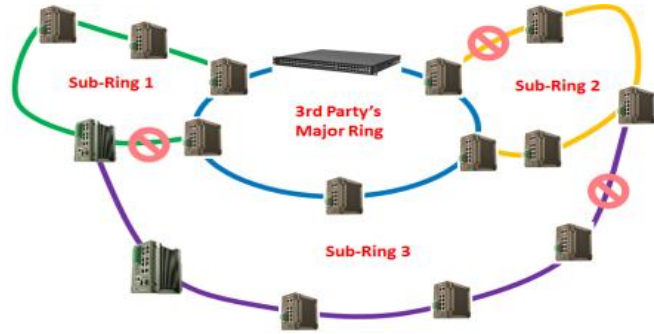
Rugged Design for Substation/Wayside

- DS412- **IEC 61850-3/ IEEE 1613 for Substation**
- **EN50121-4** for railway trackside applications
- Top level **EMC protection** and excellent heat dissipation design for operating in **-40~85°C** environment

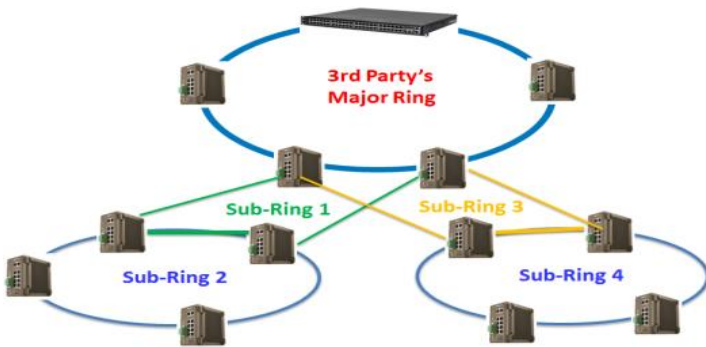
*Future Release

✓ **ITU-T G.8032 ERPSv2 gives ultimate Inter-Operability, Flexibility, and Scalability**

G.8032 v.2 ERPS is becoming the most common standard for redundancy on industrial networks and replacing proprietary ring redundancy and standard Ethernet Ring Switching, as it provides stable protection of the entire Ethernet Ring from any loops and open standard for 3rd party devices. The ITU-T G.8032 v2 ERPS recovers the network break within less than 20ms recovery time thus significantly increases network reliability for critical IIoT applications, such as heavy industrial automation (power substation and oil and gas vertical markets), ITS (traffic control, public transportation), railway networks, and other smart city applications concerning public safety.



G.8032 v1 only supports single ring topology, whilst G.8032 version 2 additionally features recovery switching for Ethernet traffic in Multiple Ring (ladder) of conjoined Ethernet Rings by one or more interconnections which saves deployment costs by providing wide-area multipoint connectivity with reduced number of links. Deploying switches with support of G.8032 v2 ERPS ensures highly resilient Ethernet infrastructure whilst simultaneously saving costs, as they can interoperate with third-party switches and still guarantee fast network recovery time without any data loss.

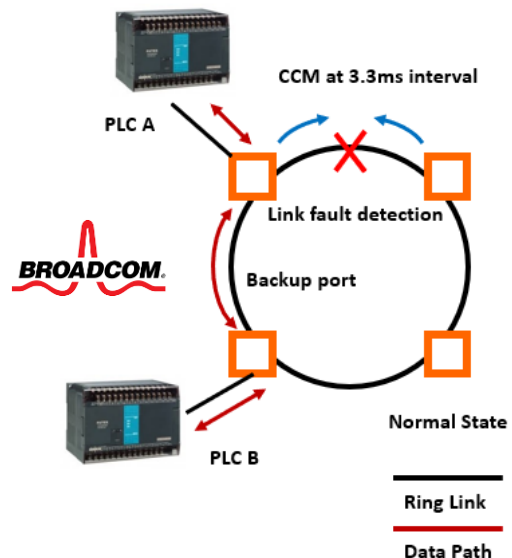
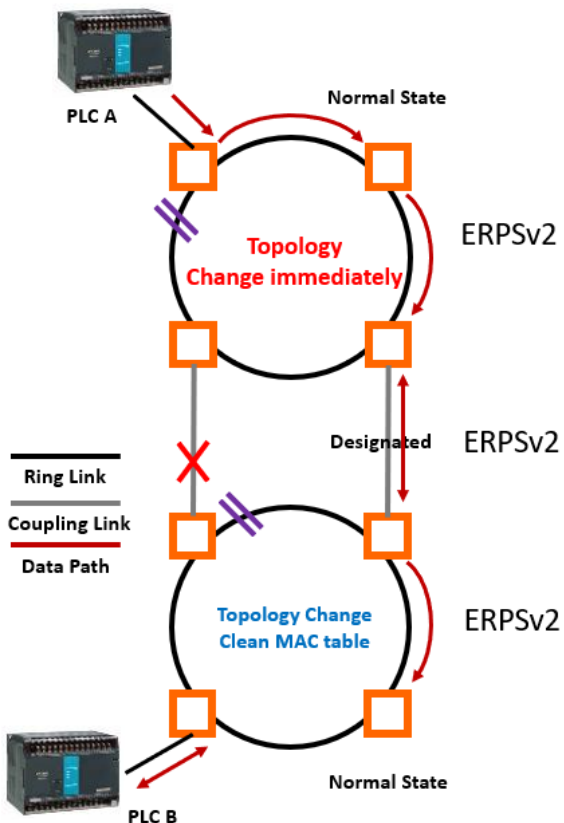


✓ **ITU-T G.8032 ERPSv2 reduces coupling Ring failure recovery time**

The G.8032 ERPS v2 technology effectively saves the recovery time for coupling ring link breakdown from 300 sec to less than 20ms by immediately change the topology of both major ring and sub ring.

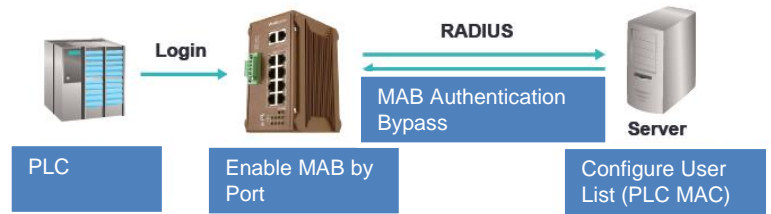
✓ **WoMaster ERPS v2 PLUS Technology – Fast Giga Copper Recovery Time**

The adaption of Broadcom® CFM Technology can reduce CFM Transmission for link failure within 3.3ms, thus to detect the ring link fault within 11.55ms (3.5 times the CFM Interval) for ERPSv2 mechanism to respond. Once the ring port fails, the ERPS RPL-Owner will forward the backup port and recover the GbE copper within 20ms under the condition that 250pcs nodes in one ring.



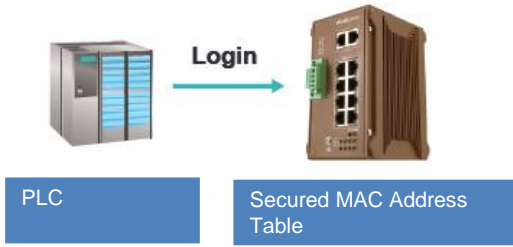
✓ **Advanced Port Based Security- IEEE802.1 x MAB (MAC Authentication Bypass)**

MAB enables port-based access control by bypassing the MAC address authentication process to TACACS+/Radius Server. Prior to MAB, the endpoint's (ex. PLC) identity is unknown and all traffic is blocked. The switch examines a single packet to learn and authenticate the source MAC address. After MAB succeeds, the endpoint's identity is known and all traffic from that endpoint is allowed. The switch performs source MAC address filtering to help ensure that only the MAB-authenticated endpoint is allowed to send traffic.



In addition to MAB, the authentication can also be done by the pre-configured static or auto-learn MAC address table in the switch.

- MAC address Auto Learning enables the switch to be programmed to learn (and to authorize) a preconfigured number of the first source MAC addresses encountered on a secure port. This enables the capture of the appropriate secure addresses when first configuring MAC address-based authorization on a port. Those MAC addresses are automatically inserted into the Static MAC Address Table and remained there until explicitly removed by the user.
- The port security is further enhanced by Sticky MAC setting. If Sticky MAC address is activated, the MACs/Devices authorized on the port 'sticks' to the port and the switch will not allow them to move to a different port.
- Port Shutdown Time allows users to specify for the time period to auto shutdown the port if a security violation event occurs.

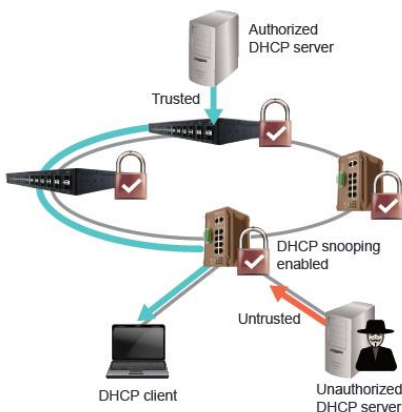


✓ **DHCP Snooping**

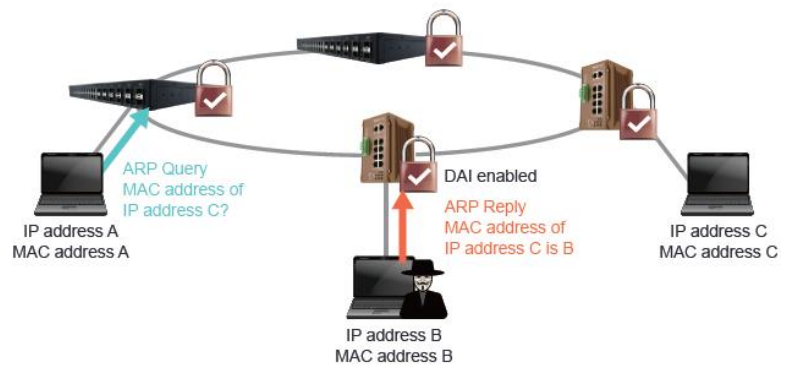
DHCP snooping acts like a firewall between untrusted hosts and trusted DHCP servers. It performs the following activities:

- Validates DHCP messages received from untrusted sources and filters out invalid messages.
- Rate-limits DHCP traffic from trusted and untrusted sources.
- Builds and maintains the DHCP snooping binding database, which contains information about untrusted hosts with leased IP addresses.
- Utilizes the DHCP snooping binding database to validate subsequent requests from untrusted hosts.

DHCP snooping is enabled on a per-VLAN basis. By default, the feature is inactive on all VLANs. You can enable the feature on a single VLAN or a range of VLANs.



✓ **Dynamic ARP Inspection (DAI)**



DAI validates the ARP packets in a network. DAI intercepts, logs, and discards ARP packets with invalid IP-to-MAC address bindings. This capability protects the network from some man-in-the-middle attacks.

DAI ensures that only valid ARP requests and responses are relayed. The switch performs these activities:

- Intercepts all ARP requests and responses on untrusted ports
- Verifies that each of these intercepted packets has a valid IP-to-MAC address binding before updating the local ARP cache or before forwarding the packet to the appropriate destination
- Drops invalid ARP packets.

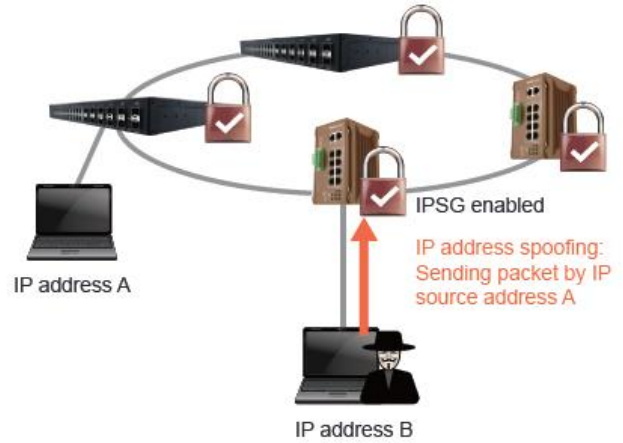
DAI determines the validity of an ARP packet based on valid IP-to-MAC address bindings stored in a trusted database, the DHCP snooping binding database. This database is built by DHCP snooping if DHCP snooping is enabled on the VLANs and on the switch. If the ARP packet is received on a trusted interface, the switch forwards the packet without any checks. On untrusted interfaces, the switch forwards the packet only if it is valid.

✓ **IP Source Guard**

IP source guard provides source IP address filtering on a Layer 2 port to prevent a malicious host from impersonating a legitimate host by assuming the legitimate host's IP address. The feature uses dynamic DHCP snooping and static IP source binding to match IP addresses to hosts on untrusted Layer 2 access ports.

Initially, all IP traffic on the protected port is blocked except for DHCP packets. After a client receives an IP address from the DHCP server, or after static IP source binding is configured by the administrator, all traffic with that IP source address is permitted from that client.

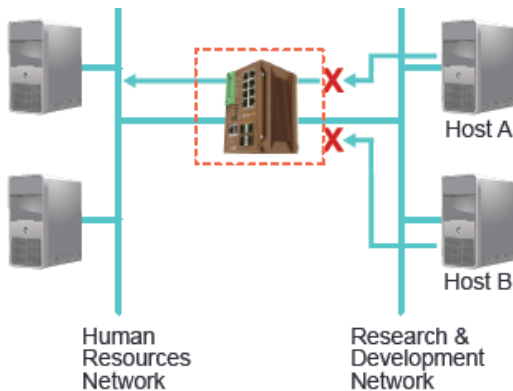
Traffic from other hosts is denied. This filtering limits a host's ability to attack the network by claiming a neighbor host's IP address.



✓ **IPv4/v6 Access Control List (ACL)**

Packet filtering limits network traffic and restricts network use by certain users or devices. ACLs filter traffic as it passes through a switch and permits or denies packets crossing specified interfaces. An ACL is a sequential collection of permit and deny conditions that apply to packets. When a packet is received on an interface, the switch compares the fields in the packet against any applied ACLs to verify that the packet has the required permissions to be forwarded, based on the criteria specified in the access lists.

WoMaster supports L2-L7 ACLs, parsing up to 128 bytes/packet and L2-L7 packet classification and filtering IPv4/IPv6 traffic, including TCP, User Datagram Protocol (UDP), Internet Group Management Protocol (IGMP), and Internet Control Message Protocol (ICMP).



X = ACL denying traffic from Host B and permitting traffic from Host A
← = Packet

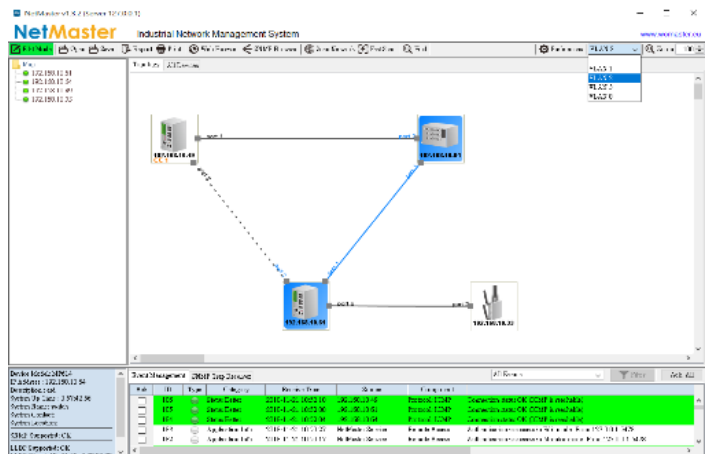
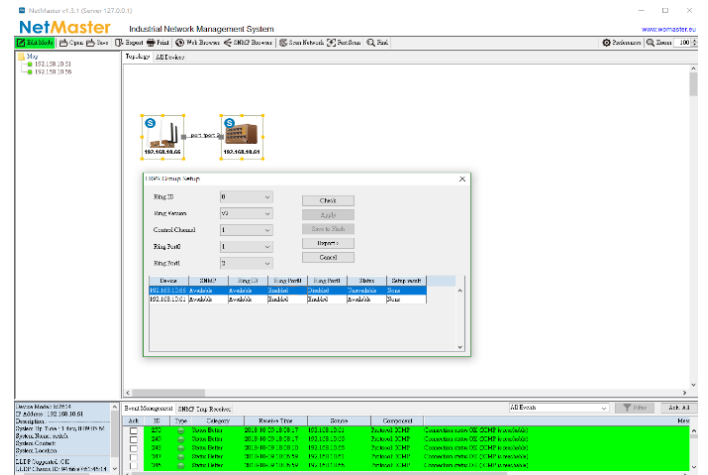
✓ **Multi-Level User Passwords**

Different centralized authentication server is supported such as RADIUS and TACACS+. Using a central authentication server simplifies account administration, in particular when you have more than one switches in the network.

Authentication Chain is also supported. An authentication chain is an ordered list of authentication methods to handle more advanced authentication scenarios. For example, you can create an authentication chain which first contacts a RADIUS server, and then looks in a local database if the RADIUS server does not respond.

✓ **NMS NetMaster Made Easy Deploy and Visualize Large Scale of ERPS Ring and VLAN**

It is very time consuming and technical to set up a large group of ERPS v2 ring. However, NetMaster NMS provides a smart way to configure a group of ERPS ring and visualize ERPS major/sub ring in purple/yellow color. With VLAN visualization, devices, ports, and links with the VLAN ID will be colored-coded.





Interfaces

DS412

Integrated Power Connector

- 1 x 8-pin terminal block
- 4 pin for redundant power input
- 2 pin DI
- 2 pin DO
- Easy installation

Gigabit Ethernet

- 8-port 100/1000MBase-T

System LED

- 2 x Power
- 1 x System Status
- 1 x DI
- 1 x DO
- 1 x Ring Status

DIN Clip

Easy System Management

- USB for Configuration/Firmware update
- RS232 console



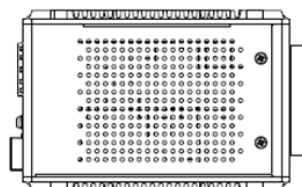
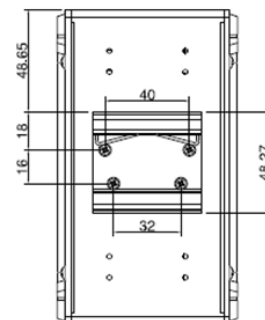
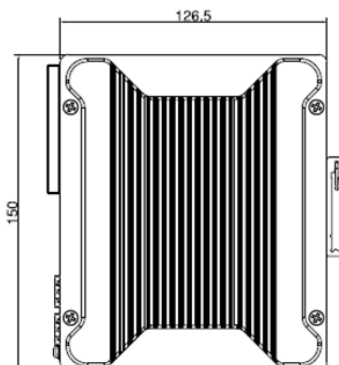
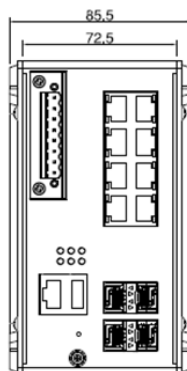
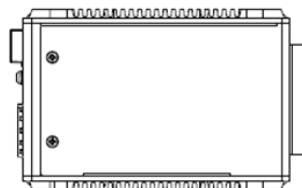
Gigabit Fiber Ethernet

- 4-port 100/1000M SFP



Dimensions

(mm)





Interfaces

DP412

Integrated Power Connector

- 1 x 8-pin terminal block
- 4 pin for redundant power input
- 2 pin DI
- 2 pin DO
- Easy installation

Gigabit Ethernet with PoE

- 8-port 100/1000MBase-T
- IEEE 802.3 af/at PoE

System LED

- 8 x PoE
- 2 x Power
- 1 x System Status
- 1 x DI
- 1 x DO
- 1 x Ring Status

Easy System Management

- USB for Configuration/Firmware update
- RS232 console



DIN Clip

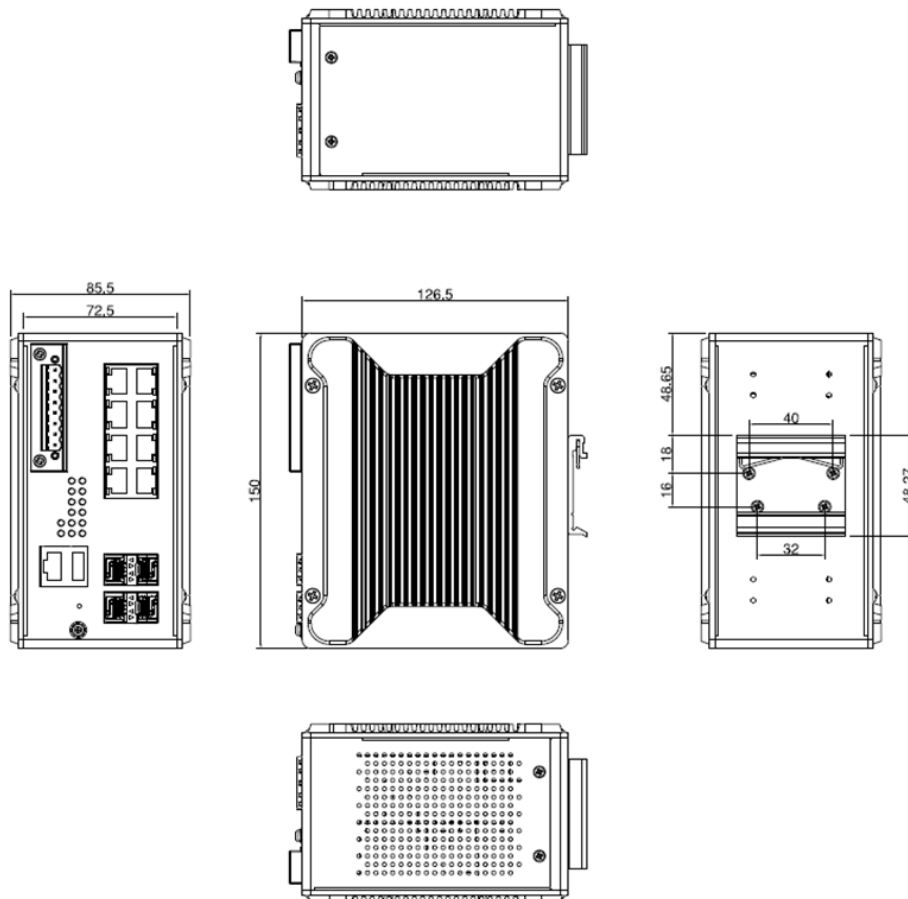
Gigabit Fiber Ethernet

- 4-port 100/1000M SFP



Dimensions

(mm)



Technology	
Standard	IEEE 802.3 10Base-T Ethernet
	IEEE 802.3u 100Base-TX Fast Ethernet
	IEEE 802.3ab 1000Base-T Gigabit Ethernet copper
	IEEE 802.3u 100Base-FX Fast Ethernet Fiber
	IEEE 802.3z Gigabit Ethernet Fiber
	IEEE 802.3x Flow Control and back-pressure
	IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
	IEEE 802.1p Class of Service (CoS)
	IEEE 802.1Q VLAN and GVRP
	IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP)
	IEEE 802.1Q-2005 Multiple Spanning Tree Protocol (MSTP)
	IEEE 802.3ad Link Aggregation Control Protocol (LACP)
	IEEE 802.1X Port based Network Access Protocol
	IEEE 1588 Precision Time Protocol v2
	IEEE 802.3af/at Power-over-Ethernet (DP412)
ITU-T G.8032 version 2 Ethernet ring protection switching (ERPSv2)	
Performance	
Switch Technology	Store and Forward Technology with 24Gbps Non-Blocking Switch Fabric Internal Packet Buffer: 1.5MBytes Forwarding rate: 41.67Mpps (1,488,000pps/port)
Number of MAC Address	16K
Jumbo Frame	9216 Bytes
VLAN	256 VLANs, VLAN ID 1~4094
IGMP Groups	512
Traffic Prioritize	8 Priority Queues per Port
Interface	
Ethernet Port	8 x 10/100/1000Base-T RJ-45, Auto-Negotiation 4 x 100/1000Base SFP, DDM
System LED	2 x Power: Green On 1 x System Status: Ready: Green On, Firmware Updating: Green Blinking 1 x DO: Red On 1 x DI : Green On 1 x Ring: Off: Ring disabled, Green On: Ring normal (Not RPL Owner), Green Blinking: Ring normal (RPL Owner), Amber On: Ring abnormal, Amber Blinking: Ring port fail
Giga Ethernet Port LED	Link (Green On), Active (Green Blinking), Speed 1000M(Amber On), Speed 100M(Off)
Giga SFP LED	Link (Green On), Active (Green Blinking), Speed 1000M(Amber On), Speed 100M(Off)
PoE LED (DP412)	8x PoE: PoE ON (Amber On)
Reset	System Reboot(2-6 Seconds)/Default Settings Reset(over 7 Seconds)
Console	1 x RJ45 based RS232 for System Configuration. Baud Rate:115200.n.8.1
USB	1 x USB for Configuration/Firmware Update
Power Input, Digital Input, Digital Output	8-Pin Removable Terminal Block Connector: 4 Pins for Redundant Power 4 Pins for DI, DO (Relay Alarm) 1x Digital Output: Dry Relay Output with 0.5A /24V DC 1x Digital Input: DI with Photo-Coupler Isolation High: DC 11~30V Low: DC 0~10V
Watchdog	Hardware-based 10 seconds timer

Power Requirement	
Input Voltage	DS412: 24VDC (10~60VDC) DP412: 48VDC (46~57VDC), 50~57VDC for IEEE802.3at
Reverse Polarity Protect	Yes
Input Current	DS412: 0.67A@24V DP412: 4.67A@54V
Power Consumption	DS412: Max 16.08W@24VDC full traffic, suggest to reserve 15% tolerance DP412: Max 18.9W@54VDC full traffic without PD loading, suggest to reserve 15% tolerance
PoE (DP412)	
Power forwarding mode	Alternative A
PoE Power Budget	PoE: Max.240W@75°C Per Port: Max. 30W
PoE Mode	IEEE 802.3af/at
Management	System/Port Power Budget Control, PoE Scheduling, PD Alive Check, PoE Status
Software	
Management	CGI WebGUI, Command Line Interface (CLI), IPv4/IPv6(RFC2460), Telnet, SNMP v1/v2c/v3, SNMP Trap/Informs*, RMON, DHCP server/client/Option 82, TFTP, System Log, SMTP
Traffic Management	Flow Control, Rate Control, Storm Control, CoS, QoS, RFC 2474 DiffServ
Filter	IGMP Snooping v1/v2/v3, IGMP Snooping Fast-Leave/Immediate-Leave, IGMP Query, GMRP, IEEE802.1Q VLAN, QinQ, GVRP, Private VLAN
Security	IEEE 802.1X/RADIUS, TLS v1.2, Access Control List (ACL, MAC/IP/ARP filter), HTTPS/SSH secure login, First login password management
Advanced Security	TACACS+, Multi-user authentication, IEEE802.1x MAB, DHCP Snooping, IP Source Guard, Dynamic ARP inspection, DoS/DDoS*, Adv. Port security*, SFTP
Redundancy	WoMaster ERPSv2 PLUS , STP/RSTP/MSTP, eRSTP, Loop Protection, Port Trunk/801.1AX/802.3ad LACP
Time Management	NTP, IEEE 1588 Precision Time Protocol v2
IIoT Industrial Protocol	Modbus TCP, EtherNet/IP*, MQTT*, RESTful API*
Private Cloud	ThingsMaster*, ThingMaster OTA*
Public Cloud	AWS Agent*, Azure Agent*
Utility	ViewMaster, NetMaster
MIB	ERPS MIB, MIB-II, Ethernet-like MIB*, P-BRIDGE MIB, Q-BRIDGE MIB, Bridge MIB, RMON MIB Group 1, 2, 3, 9*, WoMaster Private MIB
Diagnostic	LLDP, Port Mirror, Ping, Port Statistic, Event Log
Mechanical	
Installation	DIN Rail
Enclosure Material	Steel Metal with Aluminum
Dimension	85.5 x 150 x 126.5 (W x H x D) without DIN Rail Clip
Ingress Protection	IP30
Weight	1.38KG
Environmental	
Operating Temperature & Humidity	-40°C~85°C , 0%~95% Non- Condensing
Storage Temperature	-40°C~85°C
Hi-Pot Insulation	AC 1.5KV
MTBF	>500,000 hours
Warranty	5 years

Standard	
Safety	IEC60950-1 Compliance
EMC	EN61000-6-2/EN61000-6-4
EMI	CISPR 22, FCC part 15B Class A
EMS	EN61000-4-2 ESD, EN61000-4-3 RS, EN61000-4-4 EFT, EN61000-4-5, EN61000-4-6 CS, EN61000-4-8 Magnetic Field
Railway	EN50121-4
Substation	IEC 61850-3/ IEEE1613 (DS412)



Ordering Information

Model Name	Description
DS412	Industrial 8G + 4GF Layer 2 Cyber Security Switch
DP412	Industrial 8G PoE+ 4GF Layer 2 Cyber Security PoE Switch
Package List	
	1 x Product Unit (without SFP transceiver)
	1 x 8-pin Removable Terminal Connector
	1 x Attached Din Clip
	1 x Quick Installation Guide



Optional Accessory

Item	
MK-D1-2	Wall-mounting kit with 2 plates and 8 screws
CBL-RJ45F9-1.5M	Serial RS232 console cable RJ45 to DB9 Female 1.5Meter
SFPGEM05	SFP, 1000Mbps, LC, multi, 550M, 0~70°C
SFPGEM05T	SFP, 1000Mbps, LC, multi, 550M, -40~85°C
SFPGEM05D	SFP, 1000Mbps, LC, multi, DDM, 550M, 0~70°C
SFPGEM05DT	SFP, 1000Mbps, LC, multi, DDM, 550M, -40~85°C
SFPGEM2	SFP, 1000Mbps, LC, multi, 2KM, 0~70°C
SFPGEM2T	SFP, 1000Mbps, LC, multi, 2KM, -40~85°C
SFPGEM2D	SFP, 1000Mbps, LC, multi, DDM, 2KM, 0~70°C
SFPGEM2DT	SFP, 1000Mbps, LC, multi, DDM, 2KM, -40~85°C
SFPGES10	SFP, 1000Mbps, LC, single, 10KM, 0~70°C
SFPGES10T	SFP, 1000Mbps, LC, single, 10KM, -40~85°C
SFPGES10D	SFP, 1000Mbps, LC, single, DDM, 10KM, 0~70°C
SFPGES30	SFP, 1000Mbps, LC, single, 30KM, 0~70°C
SFPGES30T	SFP, 1000Mbps, LC, single, 30KM, -40~85°C
SFPGES30D	SFP, 1000Mbps, LC, single, DDM, 30KM, 0~70°C
SFPXGM03D	SFP+, 10Gbps, LC, multi, DDM, 300M, 0~70°C
SFPXGS10D	SFP+, 10Gbps, LC, single, DDM, 10KM, 0~70°C
SFPGES10-A	SFP, 1000Mbps, LC, single, 10KM, BiDi TX-1310nm RX-1550nm, 0~70°C
SFPGES10-B	SFP, 1000Mbps, LC, single, 10KM, BiDi TX-1550nm RX-1310nm, 0~70°C
SFPGES10T-A	SFP, 1000Mbps, LC, single, 10KM, BiDi TX-1310nm RX-1550nm, -40~85°C
SFPGES10T-B	SFP, 1000Mbps, LC, single, 10KM, BiDi TX-1550nm RX-1310nm, -40~85°C
SFPGES10D-A	SFP, 1000Mbps, LC, single, DDM, 10KM, BiDi TX-1310nm RX-1550nm, 0~70°C
SFPGES10D-B	SFP, 1000Mbps, LC, single, DDM, 10KM, BiDi TX-1550nm RX-1310nm, 0~70°C